Name_____

Date_____ Block_____

Notes – Properties of Logarithms

*Note that for all of these properties, the logarithms must have the same base!

Product Property: The logarithm of a product is the sum of the logarithms of its factors. (Add)

Examples: $\log_2 3 \cdot 4 = \log_2 3 + \log_2 4$ OR $\log_5 6 + \log_5 x = \log_5 6x$

In a generalized symbolic form: $\log_b mn = \log_b m + \log_b n$

You try. Rewrite the following: 1. $\log_{12} 7 \cdot 3 =$ $\log_{12} 7 + \log_{12} 3$ 2. $\ln 5 + \ln y =$ $\ln 5y$

Quotient Property: The logarithm of a quotient is the difference of the logarithms of the numerator and the denominator. (Subtract)

Examples: $\log_3 \frac{5}{7} = \log_3 5 - \log_3 7$ OR $\log x - \log(2x-3) = \log \frac{x}{2x-3}$

In a generalized symbolic form: $\log_b \frac{m}{n} = \log_b m - \log_b n$

You try. Rewrite the following: 1. $\log_{12} \frac{7}{3} =$ $\log_{12} 7 - \log_{12} 3$ 2. $\log 5x - \log 13$ $\log \frac{5x}{13}$

Power Property: The logarithm of a power is the product of the logarithm and the exponent. (Bring the exponent out front).

Examples: $\log_4 6^2 = 2\log_4 6$ OR $4\ln x = \ln x^4$

In a generalized symbolic form: $\log_b m^p = p\log_b m$

You try. Rewrite the following: 1. $\log_{15} 5^3 =$ $3\log_{15} 5$ 2. $8\log_3 2 =$ $\log_3 2^8$

NAME _____ DATE _____ PERIOD ____

10-3 Skills Practice

Rewrite as a single logarithm

1. $\log_6 3 + \log_6 4 = \log_6 12$
2. $\log 9 + \log c = \log 9c$
3. $\log_7 12 - \log_7 2 = \log_7 6$
4. $\ln 5 - \ln 2x = \ln \frac{5}{2x}$
5. $3\log_9 4 = \log_9 4^3 = \log_9 64$
6. $4\log_8 x + \log_8 3 = \log_8 3x^4$

Write as separate logarithms

7. $\ln \frac{3x}{7} = \ln 3x - \ln 7$
8. $\log_2 3x = \log_2 3 + \log_2 x$
9. $\ln 6 \cdot b^7 = \ln 6 + 7\ln b$
10. $\log \frac{x^3}{5} = 3\log x - \log 5$

Solve each equation. Check your solutions.

11. $\log_{10} 27 = 3 \log_{10} x$ $\quad 27 = x^3$ $\quad x = 3$

12. $3 \log_7 4 = 2 \log_7 b$ $\quad 4^3 = b^2$ $\quad 64 = b^2$ $\quad b = 8$

13. $\log_4 5 + \log_4 x = \log_4 60$ $\quad 5x = 60$ $\quad x = 12$

14. $\log_6 2c + \log_6 8 = \log_6 80$ $\quad 16c = 80$ $\quad c = 5$

15. $\log_5 y - \log_5 8 = \log_5 1$ $\quad \frac{y}{8} = 1$ $\quad y = 8$

16. $\log_2 q - \log_2 3 = \log_2 7$ $\quad \frac{q}{3} = 7$ $\quad q = 21$

17. $\log_9 4 + 2 \log_9 5 = \log_9 w$ $\quad 4 \cdot 5^2 = w$ $\quad w = 100$

18. $3 \log_8 2 - \log_8 4 = \log_8 b$ $\quad \frac{2^3}{4} = b$ $\quad b = 2$

19. $\log_{10} x + \log_{10} (3x - 5) = \log_{10} 2$ $\quad x(3x-5) = 2$ $\quad 3x^2 - 5x - 2 = 0$ $\quad x = -\frac{1}{3}, 2$ $\quad x = 2$

20. $\log_4 x + \log_4 (2x - 3) = \log_4 2$ $\quad x(2x-3) = 2$ $\quad 2x^2 - 3x - 2 = 0$ $\quad x = 2$

21. $\log_3 d + \log_3 3 = 3$ $\quad \log_3 3d = 3$ $\quad 3^3 = 3d$ $\quad 27 = 3d$ $\quad d = 9$

22. $\log_{10} y - \log_{10} (2 - y) = 0$ $\quad \log_{10} \frac{y}{2-y} = 0$ $\quad 1 = \frac{y}{2-y}$ $\quad 2 - y = y$ $\quad 2 = 2y$ $\quad y = 1$

23. $\log_2 s + 2 \log_2 5 = 0$ $\quad \log_2 25s = 0$ $\quad 1 = 25s$ $\quad s = \frac{1}{25}$

24. $\log_2 (x + 4) - \log_2 (x - 3) = 3$ $\quad \log_2 \frac{x+4}{x-3} = 3$ $\quad 8 = \frac{x+4}{x-3}$ $\quad 8x - 24 = x + 4$ $\quad 7x = 28$ $\quad x = 4$

25. $\log_4 (n + 1) - \log_4 (n - 2) = 1$ $\quad \log_4 \frac{n+1}{n-2} = 1$ $\quad 4 = \frac{n+1}{n-2}$ $\quad 4n - 8 = n + 1$ $\quad 3n = 9$ $\quad n = 3$

26. $\log_5 10 + \log_5 12 = 3 \log_5 2 + \log_5 a$ $\quad \log_5 120 = \log_5 8a$ $\quad a = 15$

Lesson 10-3